

An Analysis of Racial Diversity in the Breast Reconstruction and Aesthetic Surgery Literature

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Background: Racial disparities in the visual representation of patients in the plastic surgery literature can contribute to health inequities. This study evaluates racial diversity in photographs published in the aesthetic and breast reconstruction literature.

Methods: A photogrammetric analysis of plastic surgery journals from the USA, Canada, and Europe was performed. Color photographs depicting human skin, pertaining to breast reconstruction and aesthetic surgery in 2000, 2010, and 2020, were categorized as White (1–3) or non-White (4–6) based on the Fitzpatrick scale.

Results: All journals demonstrated significantly more White skin images than non-White for all procedures ($P < 0.05$) except blepharoplasty and rhinoplasty. Blepharoplasty was the only procedure with more non-White images ($P = 0.02$). When examining USA journals, significant differences were not found in blepharoplasty, rhinoplasty, and male chest surgery. European journals published a greater proportion of non-White images than USA journals ($P < 0.0001$). There was a decreasing rate of change in diversity with 15.5% of images being non-White in 2000, 32.7% in 2010, and 40.7% in 2020 ($P < 0.01$). Percentage of non-White images varied by geographical region and ranged from 3.6% in Oceania to 93.5% in Asia ($P < 0.01$).

Conclusions: Diversity of patient populations depicted in plastic surgery literature has increased over the past two decades. Despite this improvement, the racial diversity seen in photographs published in the literature does not adequately reflect this demographic for aesthetic and breast procedures. Equitable visual representation may promote cultural competency and improve care for the populations we serve. (*Plast Reconstr Surg Glob Open* 2022;10:e4487; doi: [10.1097/GOX.0000000000004487](https://doi.org/10.1097/GOX.0000000000004487); Published online 18 August 2022.)

INTRODUCTION

There is a recent focus on racial health equity in medicine. Despite this, an underrepresentation of racial minorities in medical journals, educational textbooks, and preclinical lecture slides persists.^{1–3} By this way, implicit bias can be nondeliberately perpetuated within the medical education curriculum.⁴ This leads to significant repercussions and can contribute to racial and ethnic healthcare disparities.^{5–7} Racial disparities in plastic

surgery patient care have been noted for burn injuries,⁸ cleft and craniofacial repairs,^{9,10} hand injuries,¹¹ and breast reconstructions.^{12–15}

The use of images in medical teaching improves attention, cognition, reflection, and possibly memory retention.^{16,17} In specialties like plastic surgery, images may be of greater importance as they help trainees recognize different disease stages and progression. Prior studies have shown that there is an overrepresentation of patient photographs with light skin tones,¹⁸ likely driven by both the medical journal and study authors. This racially biased educational material impacts how physicians diagnose and treat medical conditions in underrepresented minority patients.

With the advent of new technology, the challenges of photographing darker skin tones have been minimized. Although this is consistent with the increasing trend of non-White photographs in plastic surgery journals from 0% to 7.3% from 1996 to 2010, there is still insufficient visual representation of racial diversity.¹⁹ More concerning is the stratification of skin tones according to diseases,

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as some educational resources disproportionately show light skin tones with common diagnoses such as acne, and darker skin tones with more severe diagnoses, such as sexually transmitted infections.^{20,21}

In an era of antiracism advocacy, the onus is on the medical community to call for greater diversity in patient images and photographs as a teaching tool. We must accurately reflect the racial composition of the patient population to avoid unintentionally promoting implicit bias. To create this change, it is important to identify racial disparities in plastic surgery research, reflect on our progress, and increase awareness. This may help reduce implicit bias and allow for greater health care equity.

The aim of this study was to use established photogrammetric analysis techniques to evaluate racial diversity in the visual representation of aesthetic and breast surgery literature and to compare trends in Canada, the USA, and Europe.

METHODS

Data Collection

Plastic surgery journals across Canada, the USA, and Europe were selected for analysis, including *Plastic Surgery (PS)*, *Plastic and Reconstructive Surgery (PRS)*, *Aesthetic Surgery Journal (ASJ)*, *Journal of Plastic, Reconstructive and Aesthetic Surgery (JPRAS)*, and *Aesthetic Plastic Surgery (APS)*. These journals were selected as the highest impact journals pertinent to aesthetic surgery and breast reconstruction. All articles with colored photographs, pertaining to breast reconstruction and aesthetic surgery in 2000, 2010, and 2020, were selected for inclusion. These years were selected to assess for any trends over the last two decades. Our exclusion criteria were any article with figures of nonhuman subjects, implants, bone, muscle, fat, nerve, and internal organs, or which did not contain sufficient skin for accurate analysis. Demographic information regarding the article's country of origin, corresponding author(s), first author, and the title were collected for analysis.

Photometric Analysis

While recognizing that race is a social construct without biological basis, skin tone was used as a proxy for race. Previously established methods were used.^{18,19,22} The Fitzpatrick scale along with photogenic and surname data was used to categorize images. Each image was categorized as "White" or "non-White," which includes Asian, non-White Hispanic, Native American, African American, and multiracial individuals based on the above criteria. Each image was analyzed by two authors independently (S.C. and H.S.), and any discrepancies were brought to the senior author (A.P.).

Interrater Reliability

Interrater reliability was determined based on a collection of 30 images chosen independently by the senior researcher. Each author reviewed the image using the methods outlined above. All responses were single-blinded

Takeaways

Question: Does the racial diversity in photos published in the plastic surgery literature reflect patient diversity and vary based on the article's country of origin?

Findings: Photographs from five plastic surgery journals were analyzed for the visual representation of diversity. There was a significant increase in depicted diversity from 2000 to 2020, but a wide variation in published non-White skin images was noted based on the article's region of origin.

Meaning: Depicted diversity has increased over the past two decades; however, authors based in countries with a racially diverse population should reflect this diversity more accurately in their published photographs to promote cultural competency.

and evaluated for interrater reliability using Fleiss' kappa. Interpretation of kappa was based on Landis and Koch cut-offs for correlation reliability: 0.01–0.20 slight agreement, 0.21–0.40 fair agreement, 0.41–0.60 moderate agreement, 0.61–0.80 substantial agreement, and 0.81–0.99 almost perfect agreement.

Statistical Analysis

The average number of White and non-White images per article, across the different regions, was compared using a two-tailed Student *t* test. The average number of White and non-White images over the last two decades was evaluated with a univariate regression analyses. Pearson correlation coefficient (*r*) was calculated for all univariate regression analyses. Statistical significance was set at a *P* value less than 0.05.

RESULTS

Interrater Reliability

The interrater reliability for grading skin type was determined to have a *k* coefficient of 0.85 ($P < 0.01$). This indicated substantial agreement between both researchers (S.C. and H.S.).

Visual Representation of Racial Diversity

A total of 614 published articles with 2441 images met the inclusion criteria (Table 1). Of all these images, 783 (32.1%) images depicted non-White skin and 1658 (67.9%) images depicted White skin ($P < 0.0001$). The majority of images (1460 images, 59.8%) were published in articles about rhinoplasty (333 images), aesthetic breast augmentation/mastopexy (312 images), facelift/neck (282 images), aesthetic trunk (267 images), and facial injectables (266 images). There were significantly more White skin images than non-White for all procedures ($P < 0.05$) except blepharoplasty and rhinoplasty. Blepharoplasty was the only procedure, which had significantly greater non-White skin images than white skin images ($P < 0.05$). On the other hand, there was no statistically significant difference between white skin images and

non-White skin images for rhinoplasty. When examining only USA-based journals, significant differences were not found in blepharoplasty, rhinoplasty, and male chest surgery. Overall, there were 2.70 average White skin photographs per article compared with 1.28 average non-White photographs per article ($P < 0.001$).

Temporal Trends in Racial Diversity

Temporal analysis revealed that there has been an increase in diversity over time from 15.5% of articles including non-White photographs in 2000 to 32.7% in 2010 and 40.7% in 2020 ($P < 0.01$). However, on linear regression analysis, there was a trend for a decreasing rate of change in diversity ($P < 0.01$).

Globalization and Visual Representation

When comparing different countries of publication, it was noted that European journals published a greater proportion of non-White images than USA-based journals ($P < 0.0001$). The Canadian journal did not have any statistically significant difference between White skin images and non-White skin images. Similarly, there were no significant differences between proportion of non-White images published in USA or European journals compared with Canada ($P > 0.05$).

The percentage of White and non-White skin tones for all published articles by country of origin varied depending on geographical region (Figs. 1–3). Only 10.6% of all images published in plastic surgery literature in the USA and Canada depicted non-White skin tones. Notably, the percentage of non-White images for all published articles by continent of origin ranged from 3.6% in Oceania and 10.2% in Europe to 93.5% in Asia ($P < 0.001$). The vast majority of the diversity is the result of publications from Asia.

DISCUSSION

This study provides insights on racial diversity trends in the visual representation of aesthetic and breast surgery literature. The main finding of this study is that there are a significantly greater proportion of White skin images than non-White skin images, in aesthetic and breast surgery literature across the USA and Europe. This suggests that an underlying implicit bias exists in published medical images for patients with non-White skin tones.

The proportion of White skin images published in the USA are considerably greater than the White USA demographic and patients seeking aesthetic procedures. Specifically, only 10.6% of images published in plastic surgery literature in the USA depicted non-White skin tones, despite the 2020 USA Census revealing that the racial distribution of the population was 62% White and 38% non-White.²³ Meanwhile, the 2020 *Plastic Surgery Statistics Report* indicates that the racial distribution for patients seeking aesthetic procedures was 66% White and 34% non-White.²⁴ These study results are consistent with previous studies.^{18,19,22,25} The proportion of White skin images published in Canada are considerably fewer than the White Canadian demographic.²⁶

We also note that blepharoplasty was the only global aesthetic procedure which had a significantly higher proportion of non-White skin images than White skin. This may be partly explained by the fact that this procedure is incredibly popular among the Asian population.²⁷ There was also an increased representation of non-White patients in publications where the authors were from Asia and South America. We identified a temporal trend toward increased racial diversity over the last two decades, which may be partly explained by the growing globalization of medical research. Although the lack of diversity

Table 1. Analysis of Aesthetic and Breast Reconstruction Images Depicting Human Skin Tone

Canada, USA, and Europe Journals					
	Articles	Images	White Skin (%)	Non-White Skin (%)	P
Autologous breast reconstruction	91	228	182 (79.8)	46 (20.2)	<0.0001
Implant-based breast reconstruction	46	145	101 (69.7)	44 (30.3)	<0.0005
Breast reduction	41	118	71 (60.2)	47 (39.8)	0.048
Aesthetic breast augmentation/mastopexy	94	312	254 (81.4)	58 (18.6)	<0.0001
Blepharoplasty	50	244	106 (43.4)	138 (56.6)	0.020
Facelift/neck	56	282	226 (80.1)	56 (19.9)	<0.0001
Facial injectable	72	266	165 (62.0)	101 (38.0)	<0.0001
Aesthetic trunk	46	267	222 (83.1)	45 (16.9)	<0.0001
Rhinoplasty	75	333	176 (52.9)	157 (47.1)	0.830
Male chest/gynecomastia	14	34	26 (76.5)	8 (23.5)	0.014
Other (eg, aesthetic genital, scar revisions, and lasers)	61	212	129 (60.8)	83 (39.2)	0.020
Total	614	2441	1658 (67.9)	783 (32.1)	<0.0001
USA Journals Only					
	Articles	Images	White Skin (%)	Non-White Skin (%)	p
Autologous breast reconstruction	34	116	87 (75.0)	29 (25.0)	<0.0001
Implant-based breast reconstruction	20	82	78 (95.1)	4 (4.9)	<0.0001
Breast reduction	18	59	37 (62.7)	22 (37.3)	0.077
Aesthetic breast augmentation/mastopexy	26	84	77 (91.7)	7 (8.3)	<0.0001
Blepharoplasty	18	116	85 (73.3)	31 (26.7)	0.112
Facelift/neck	29	146	125 (85.6)	21 (14.4)	<0.0001
Facial injectable	27	109	77 (70.6)	32 (29.4)	0.027
Aesthetic trunk	28	109	101 (92.7)	8 (7.3)	<0.0001
Rhinoplasty	38	177	121 (68.4)	56 (31.6)	0.277
Male chest/gynecomastia	3	9	8 (88.9)	1 (11.1)	0.058
Other (eg, aesthetic genital, scar revisions, and lasers)	31	109	86 (78.9)	23 (21.1)	<0.0001
Total	272	1116	882 (79.0)	234 (21.0)	<0.0001

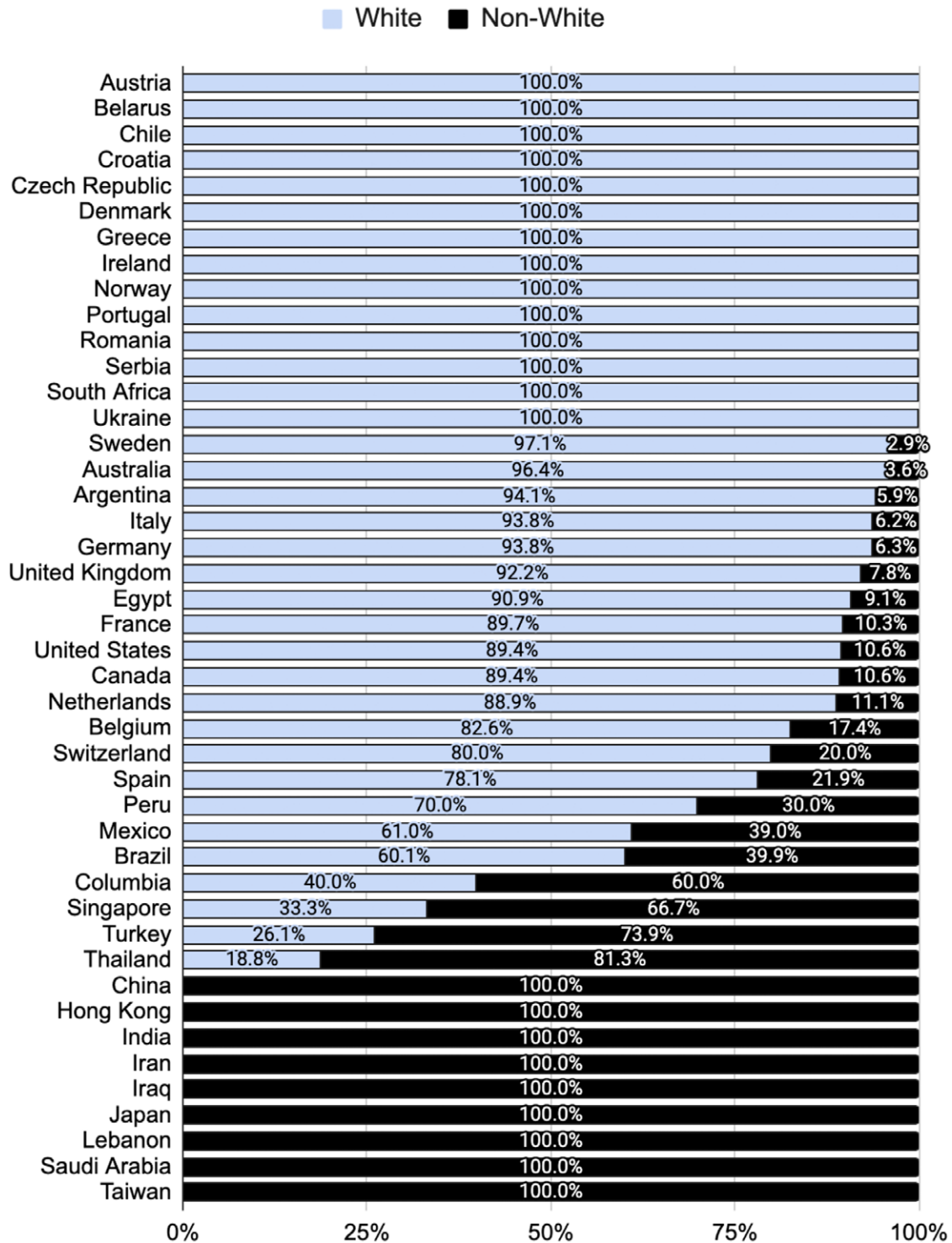


Fig. 1. Representation of White and non-White skin tones for all published articles by country of publication (White, blue bars; non-White, black bars).

seen is likely due to a complex interplay of various factors, these results suggest that an underlying implicit bias among plastic surgery researchers may be present.

Implicit bias may lead to authors including images of non-White skin patients in their articles, or journal reviewers accepting articles with White-skin images. This can be

further amplified and affect how physicians and surgeons interpret published visual materials and, in turn, impact their delivery of patient care.^{22,28} Given that health care providers will likely be exposed to an overwhelming amount of patient images with White skin, this may further perpetuate racial biases when they provide care for minority patients.

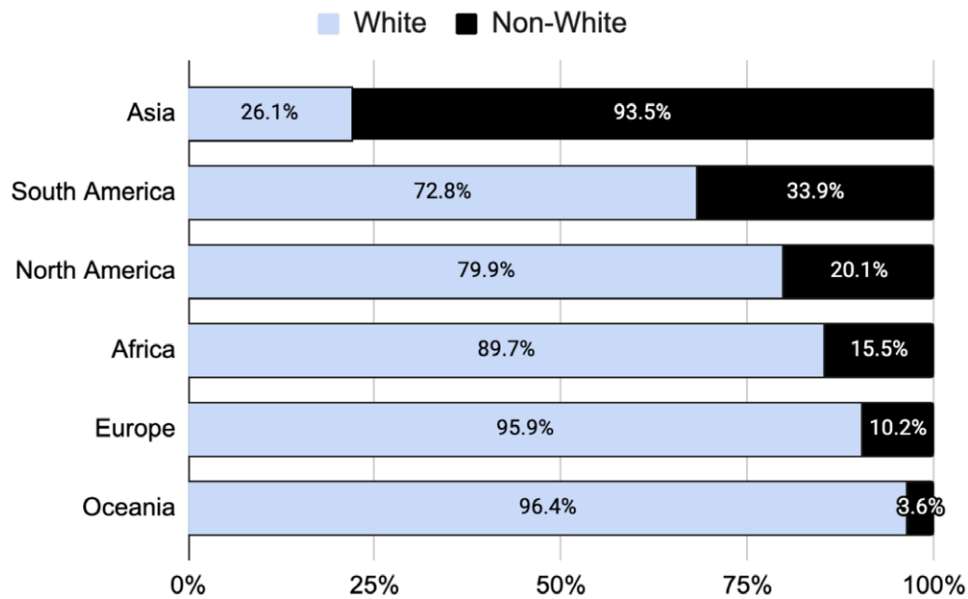


Fig. 2. Representation of White and non-White skin tones for all published articles by continent of publication (White, blue bars; non-White, black bars).

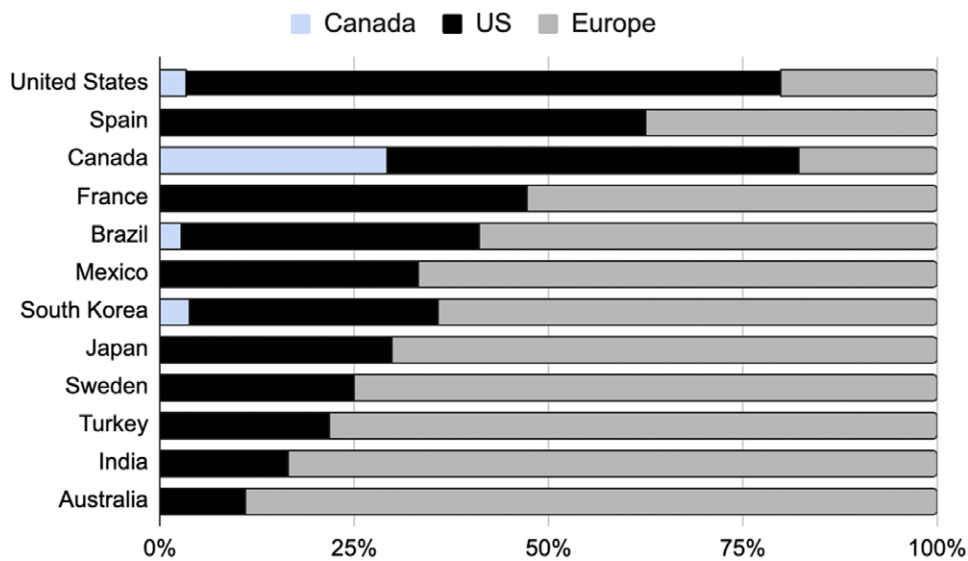


Fig. 3. Distribution of country of origin for all published articles by country of publication (Canada, blue bars; US, black bars; Europe, gray bars).

It is important that the racial distribution of patients in medical literature reflects the patient demographics of the disease or procedure. Several strategies may be implemented to promote this further. First, increased awareness and discussions around implicit racial bias are important. By educating researchers and health care providers that their implicit biases predict their behavior, we can prevent racism from affecting the quality of care they provide. Second, there are currently no guidelines requiring research authors to include patient images with non-White colored skin. Journal guidelines included as part of the instructions for authors could help promote this parity. Third, another important way of increasing representation of diversity in published photographs is to increase the

number of non-White surgeons in the profession. Fourth, further investigations are required to better understand the observed patterns. Although it may be possible that researchers are not using pictures of minorities, another possibility may be that perhaps minorities refuse to consent to have their photographs used due to cultural practices or beliefs.

Future studies may want to identify and quantify factors besides implicit bias that may be contributing to this racial visual disparity. Studies may also choose to assess how the racial disparity in visual representation compares to different plastic surgery subspecialties. Future studies may also wish to further classify origin of articles by state and/or region. This will allow for better comparison between proportion of

White skin images published and that region's demographic. Next, it would be interesting to investigate the relationship between White/non-White authors and proportion of published White/non-White images. Future studies may wish to collect race data on first and/or senior authors.

There are several limitations to this study. First, this study is derived from a limited sample of data; at certain times only single articles represented a country of publication. It is possible that some articles may have a larger focus on racial diversity than others, which may skew results. However, each selected journal represents the highest impact factor journals by the country. Second, the use of skin tone to identify the image as White or non-White uses a binary classification system. This does not represent the true diversity in the images evaluated. This methodology has been previously validated.^{18,19,22,25} Third, this analysis was limited in only using procedural data from the United States. Detailed procedural statistics from Canada and throughout Europe were not available to allow for a region-specific analysis.²⁹ Fourth, it is also important to note that while a patient's skin color may dictate their lived experiences, it should not be confounded with ethnicity. Race is a social construct, and there is no biological basis for it. Race includes phenotypic characteristics such as skin color and hair type, whereas ethnicity encompasses factors such as culture, ancestry, and language.

CONCLUSIONS

It is important that we promote cultural competency and study the influence of race and culture on the daily experiences of patients. Implicit bias has been thoroughly documented in medical education and patient care. It is likely one of the contributing factors to racial inequities in medicine. The results of this study will support the ongoing endeavors of encouraging authors to evaluate their implicit bias when including medical images.

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